

## LA-UR-14-21562

Approved for public release; distribution is unlimited.

Title: Annual Report on Numerical Study of Strong and Coherent Radiation of Terahertz Electromagnetic Waves from High-Tc Superconductors

Author(s): Lin, Shizeng

Intended for: annual report for institute computing Report

Issued: 2014-03-10



### Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

# Annual Report on Numerical Study of Strong and Coherent Radiation of Terahertz Electromagnetic Waves from High- $T_c$ Superconductors

Shi-Zeng Lin

T-4, theoretical division, Los Alamos, NM, USA

Email: [szl@lanl.gov](mailto:szl@lanl.gov)

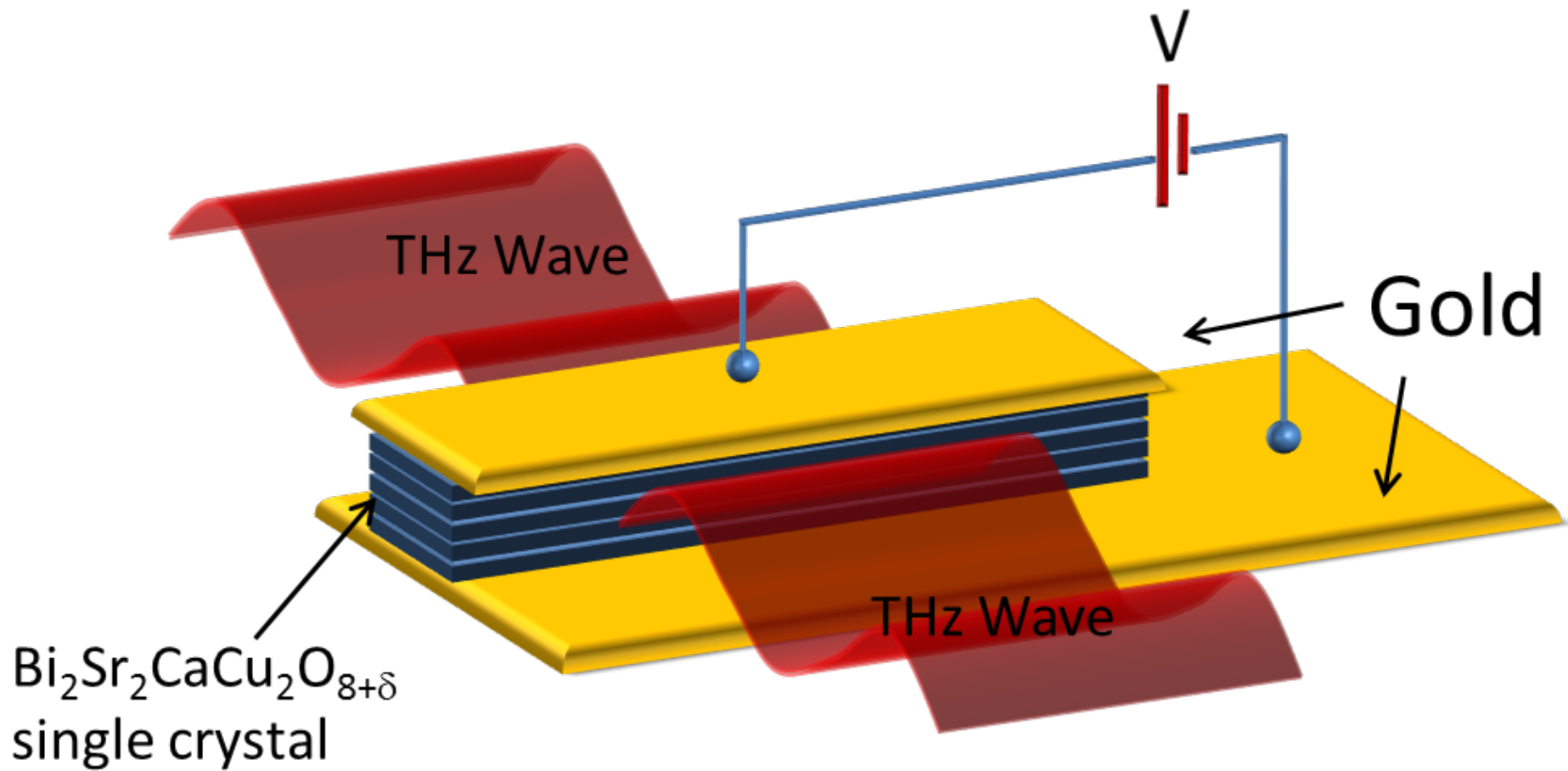


Fig. 1, schematic view of the setup for THz radiation from cuprate superconductors.

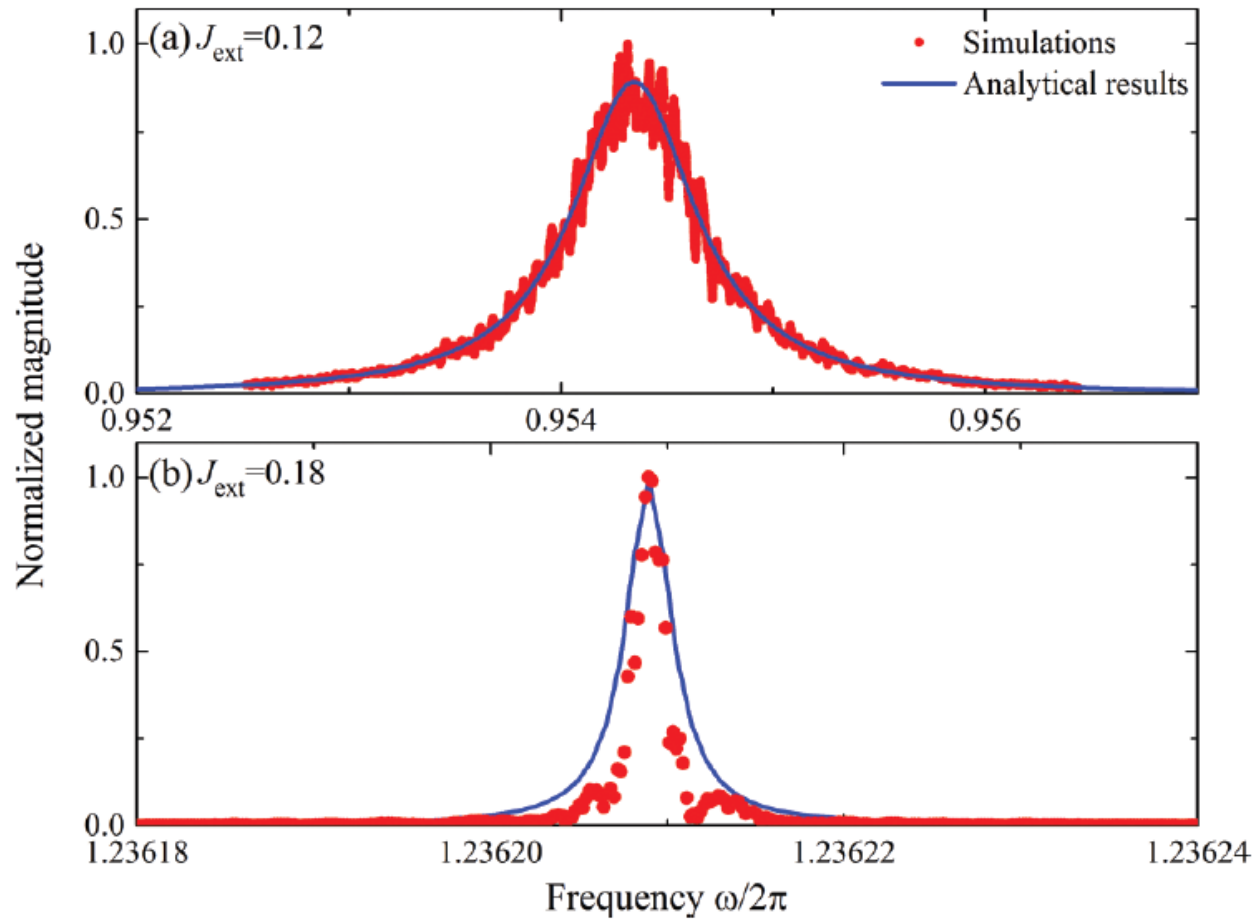


Fig. 2, Comparison of the line shape obtained analytically and numerically both off the resonance (a) and at the resonance (b). The linewidth sharpens significantly at the cavity resonance.

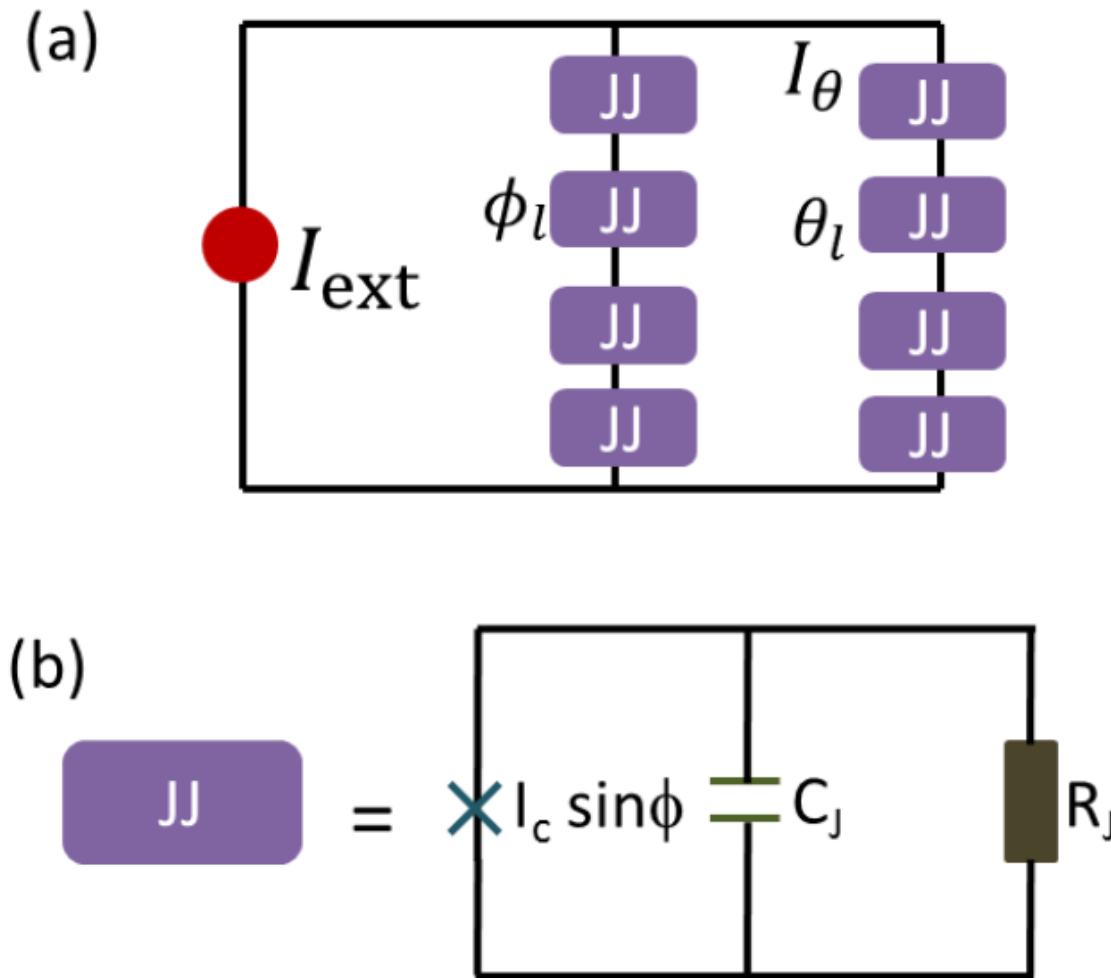


Fig. 3, (a) Schematically view of two stacks of intrinsic Josephson junctions shunted in parallel and biased by a dc current. In order to tune the phase difference between the plasma oscillation in the two stacks by a magnetic field, the wire connecting all the junctions should also be superconducting. (b) The Josephson junction is modeled as a shunt circuit of a capacitor, a resistor, and a nonlinear Josephson current.

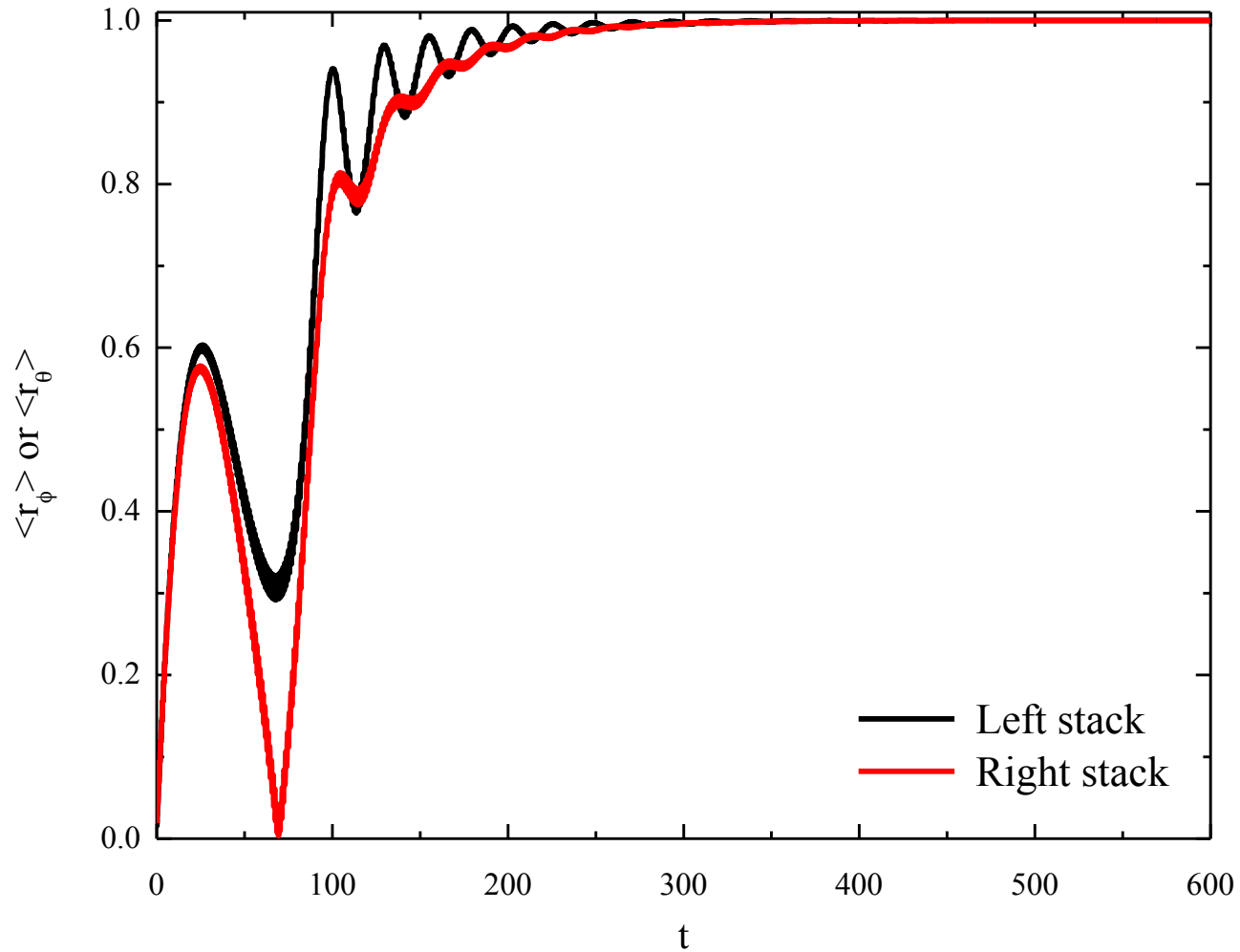


Fig. 4, (a) Amplitude of the order parameter as a function of time starting from a completely random state for number of junctions equal to 400. The junctions are fully synchronized when the order parameter is equal to 1.